

Synergistic effects of sludge rheology and chemistry on anaerobic digestion

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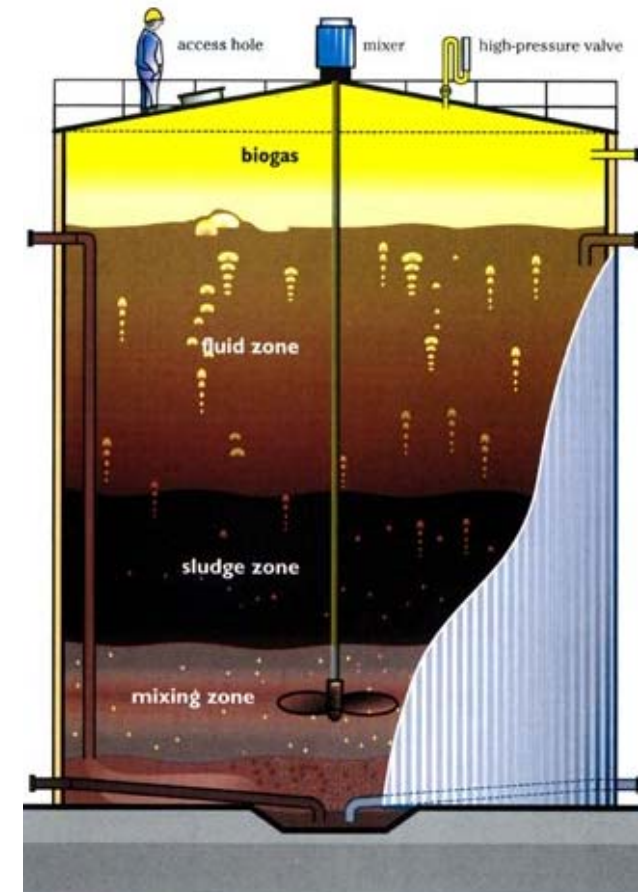


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Anaerobic digestion improvement

- Efficiency of organic matters removal by anaerobic digesters is substantially low.
- Biogas production yield is not commercially satisfactory.
- Increasing organic matters load failed to increase biogas production.

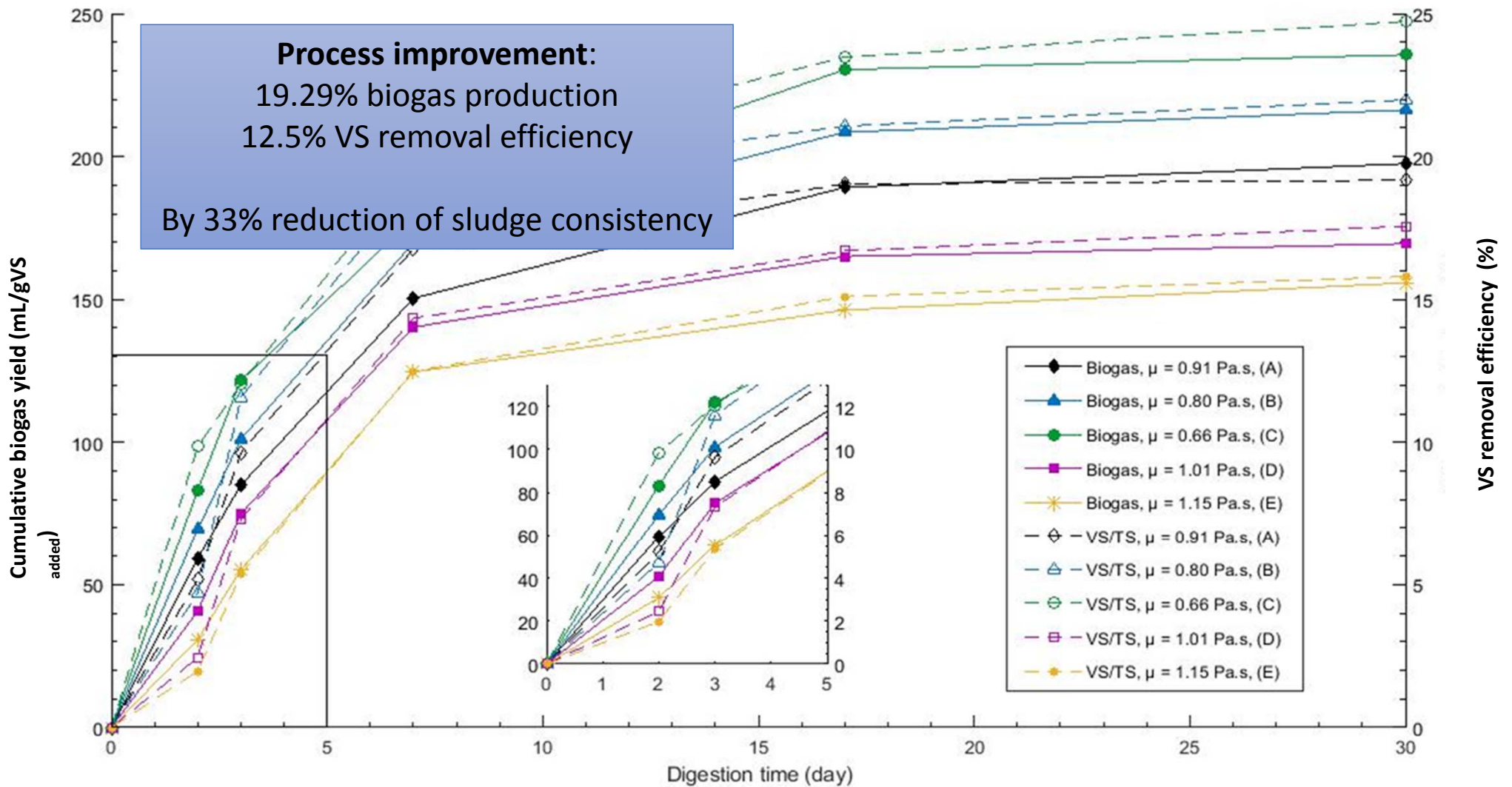


Research objectives

- To understand the reason why AD cannot thoroughly convert sludge into biogas.
- To address the current challenge of AD unsustainability.
- To maximise the biogas production yield.

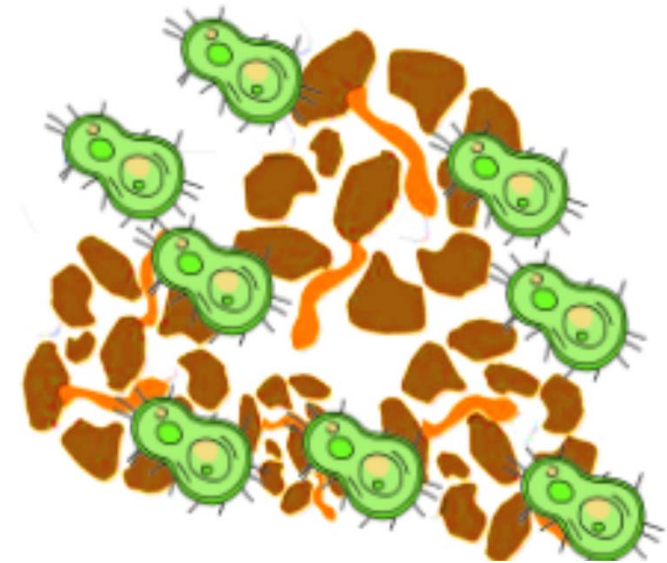
To benefit biogas yield and organic matters removal

Process improvement:
 19.29% biogas production
 12.5% VS removal efficiency
 By 33% reduction of sludge consistency

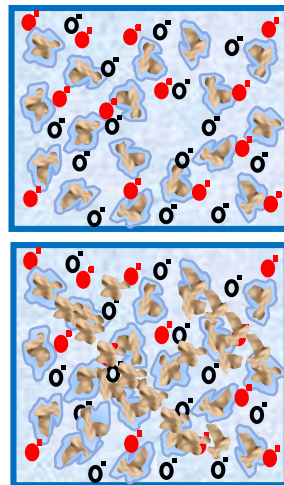
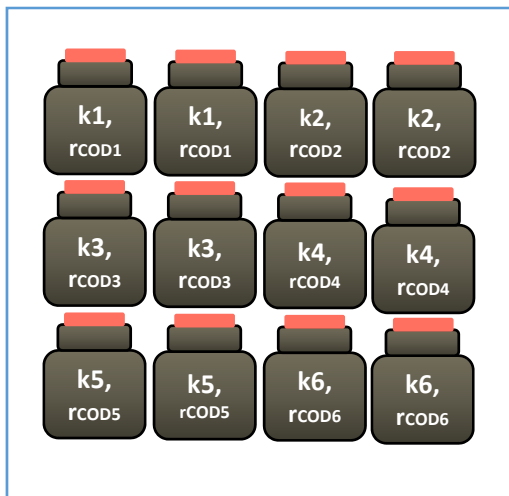


Research findings

- Sludge non-Newtonian fluid behavior is responsible for poor digestion.
- Sludge consistency and structure affect homogenization, mixing, mass and heat transfer.
- Measurement and control of sludge rheological properties can improve AD performance.



Research implementation to optimise biogas production yield



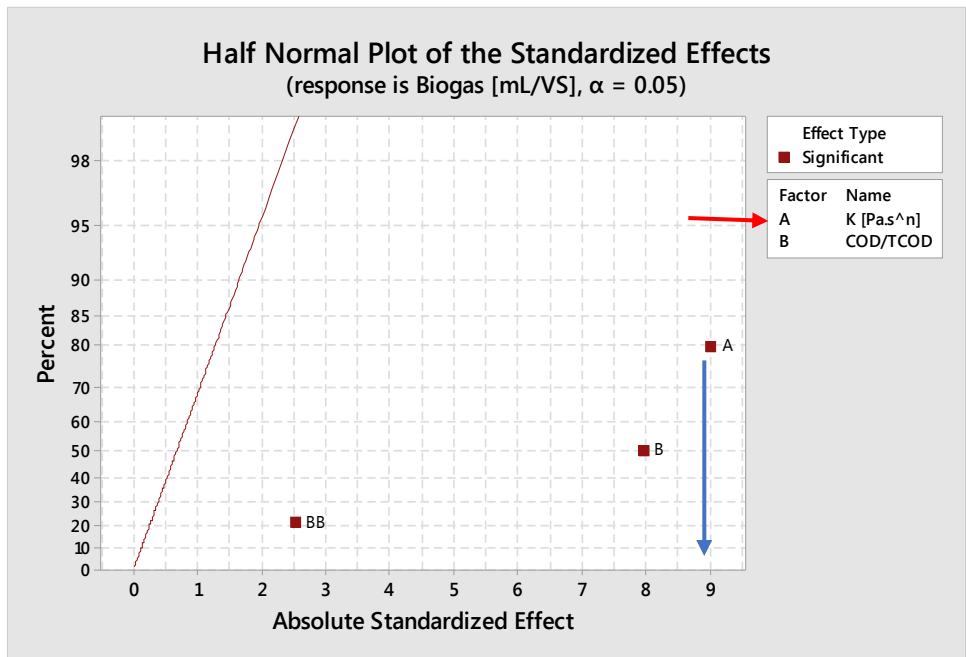
Significant design parameters:

Consistency index (k) & biodegradability (sCOD/tCOD)

- a) Sludge rheological properties can identify solids content and particle interactions.

b) Cumulative biogas yield $\left(\frac{mL}{grVS}\right) = \beta_0 - \beta_1 k + \beta_2 \frac{sCOD}{tCOD} - \beta_{22} \frac{sCOD}{tCOD} \times \frac{sCOD}{tCOD}$

Consistency index





What would be a new technique that would be a game-changer?

Development of a convenient tool for optimization of anaerobic digesters, using rheological measurement of the sludge.



Acknowledgements

- A./Prof. Nicky Eshtiaghi and Dr. Maazuza Othman, RMIT university.
- RMIT university, supporting this research by scholarship.
- Melbourne water, supplying sludge samples.